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LIGHT UP AT NIGHT AND "DAYLIGHT" SAVE

The Facts...

Leaving outdoor lights burning during the day is costing some Albertans unnecessary energy dollars. Based on available light, a simple, inexpensive photo-electric lighting control can automatically turn lights and other equipment on at night and off during the day to save money.

Designed for streetlights, security and other types of exterior lights, photo-electric controls, or photocell controls as they are often called, can be used for wall-mounted security lights, canopies in gas bars, outdoor covered parkades and commercial signs.

The most common photo-electric controls utilize photovoltaic or photoconductive cells. These devices convert light energy into electrical energy. With the aid of solid state electronic devices, the electrical energy is amplified to operate a relay. The relay, in turn, is connected to the light circuit and turns lights on or off according to outside light levels.

Most photo-electric controls have a sensitivity adjustment which consists of a metal band that slides in front of the photo conductive cell. Setting the sensitivity to activate lights during dull or overcast days is an example of how it could be used.

Available in transparent resin or glass envelopes, the photo-conductive cell is stable at low temperatures, a critical feature when used outdoors during Alberta's cold winter temperatures. Typical operating conditions range from –40°F (–40°C) to 170°F (77°C).

Thermal relays are used for most outdoor lighting applications. This type of relay allows for a 15- to 120-second time delay to prevent the light from being accidently turned off as a result of lightning flashes or stray automobile headlights.

In many cases, this feature can help extend the life of the controlled lamp and improve safety because lights are not shut off at the most critical and hazardous periods during storms. A weatherproof cover protects the circuitry from ultraviolet light degradation, moisture and low temperature impacts.

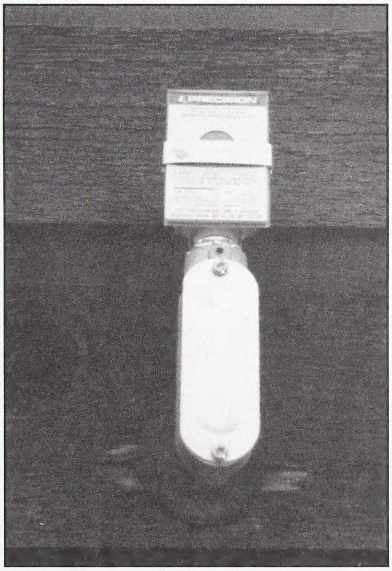


Photo-electric control

Electromagnetic relays are used when a quick response time is needed, i.e. less than one second. They help reduce the time and costs associated with field tests and new installation tests. The thermal relay is temporarily replaced with an electromagnetic type during testing situations.

Most photo-electric controls cost less than $30 and will provide up to 5000 on/off operations. Installing this type of control can be a dependable and low-cost way to save automatically on electrical energy costs.

The Application...

The City of Edmonton Public Works Micrographics Building is a single-storey city owned and occupied office building with 5200 sq.ft. (483 m^2) of floor area. To get help assessing the energy use and to identify areas of potential savings, the City of Edmonton requested the Alberta Energy Bus to conduct an energy audit of this building. Following suggestions of the audit team, a photocell to control lighting the entrance area was installed.

The photo control is connected to lamps in the vestibule and under the outdoor canopy. These lamps previously were operating continuously. Now the lamps operate only when there is not enough natural light to do the job. This reduced the operating time by approximately 4300+ hours per year.

The city used its own staff to do the installation. The cost to install the photo control was approximately $200. The addition of the photo control is now saving the city 3337 kW•h's or about $96 a year in electrical costs. The investment payback has taken just over two years.

Installation of photo-electric control for canopy and vestibule lights.

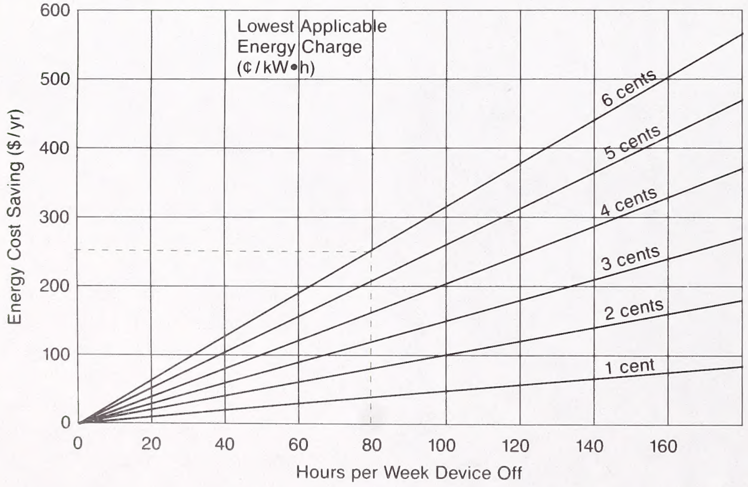
The Bottom Line . . .

The example of The City of Edmonton Public Works Micrographics Building shows that a simple photo controller is a very worthwhile energy efficiency measure. Not only will it reduce the energy used by the lamps, but extend their useful service life.

To check their forecast annual savings, building managers can use the accompanying graph and technique described below. The cost of electrical energy should be based on the rates from the utility that serves the building in question.

Figure 1 shows the potential electricity energy cost savings per year for a 1000-watt device. Savings are based on the number of hours the device(s) are off per week and the lowest energy charge that applies at your building (probably in the range of 1 to 6 cents per kW•h). The broken green line on the graph shows the potential cost savings for the example calculation.

FIGURE 1 **Energy Cost Saving of a 1000 Watt Device**



EXAMPLE

Install a photo control to shut off ten 75 watt flood lights during daylight hours.

Reduce the number of daylights hours per week by 80.

The lowest applicable energy charge is 6 cents per kW•h.

The cost of installation is $200.

Electric energy cost savings (using graph) = $250/year

Adjustment factor for actual wattage being calculated:

75 watt lights × 10 lights divided by 1000 = 0.75

Annual savings $250/year × 0.75 = $187/year

Installation cost = $200

Simple payback

$$\frac{\$200 \text{ cost}}{\$187 \text{ annual savings}} \times 12 \text{ months} = 12.83 \text{ months}$$

Note: If lights are to be shut off for all daylight hours for one year, the total average daylight hours are 84/week.

Savings Potential in Apartments and Condominiums 40,000 sq.ft. or less

Energy use varies widely, depending on the type of building and the activities in that building. This variance in energy use has become evident following Energy Bus audits of almost every type of facility.

An energy audit determines initially how energy is being used and how much it costs in each area. Energy efficiency measures are then identified which may result in energy cost savings. On average, the Energy Bus has identified potential savings of about 19 per cent.

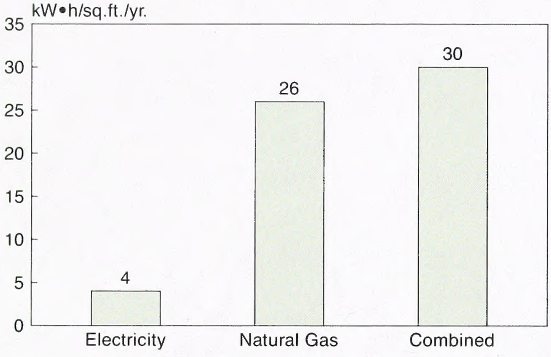
Figure 2 shows energy use for apartments and condominiums 40,000 sq.ft. (3717 m²) or less. In this analysis, an annual energy usage based on building floor area is indicated for natural gas, electricity, and combined electricity and natural gas.

Figure 3 compares energy cost. In Alberta, natural gas is the least expensive form of energy. For the apartment and condominium sector the average price of a unit of electrical energy is 7.6 times that of an equivalent unit of natural gas. Therefore, when analyzing energy use, the energy cost must also be considered.

Lighting represents 43 per cent of the electrical use as shown in Figure 4.

Energy Bus audits have identified considerable potential for reducing lighting costs at four facilities. Installing photocell controls at these facilities to shut off lights during daylight periods can save 13 per cent of lighting costs as shown in Figure 5.

FIGURE 2 **Apartments and Condominiums < 40,000 ft² (3712 m²)**



(Multiply by 10.76 to convert kW•h/m²/yr.)

FIGURE 4 **Electrical Use in Apartments and Condominiums < 40,000 ft² (3717 m²)**

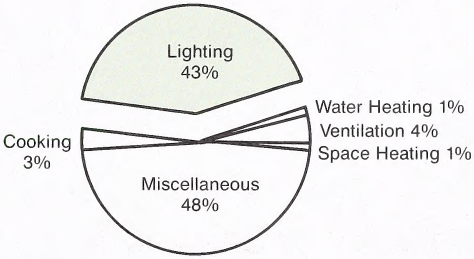


FIGURE 3 **Apartments and Condominiums < 40,000 ft² (3717 m²) Energy Use and Cost**

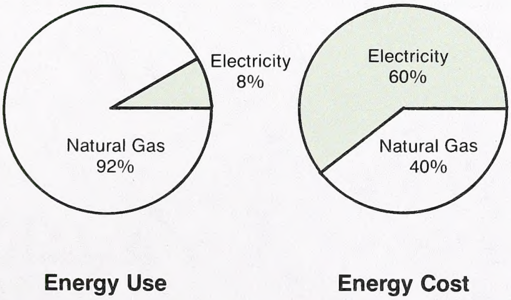
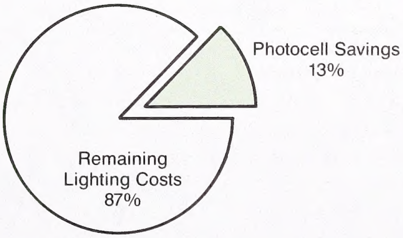


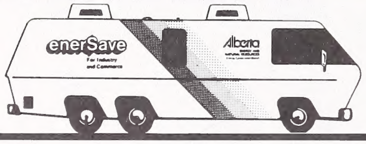
FIGURE 5 **Potential Cost Savings**



FOR MORE INFORMATION

The article *Light Up At Night and "Daylight" Save* was researched by Dave Whitfield and the Sector Review completed by David Supruniuk. The Energy Efficiency Branch gratefully acknowledges the editorial reviews of *The Facts* . . . by Neil Forsyth, Illuminating Engineering Society of North America and *The Application* . . . by Earl Cornfield, City of Edmonton Public Works.

For detailed information on energy cost-savings calculations and the energy audit database, contact the technical services section of the Energy Efficiency Branch: Phone 427-5200 (collect).



ENERGY $AVER$

Energy $aver$ is a series of fact sheets about energy efficiency measures that have wide application in Alberta. Each issue highlights a different technology and its successful use in the province. The Sector Review summarizes energy use patterns of different facilities that have used Alberta's Energy Bus audit service. Comments, questions, and suggestions are welcome.

Write or phone (collect) to be placed on the mailing list. You may also receive back issues or arrange for an Energy Bus audit (conducted at no charge).

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